GEOTECHNICAL INVESTIGATION
MATADERO CREEK IMPROVEMENTS
FROM MIDDLEFIELD ROAD TO
PARK BOULEVARD
Palo Alto, California

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Woodward-Clyde Consultants

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MATADERO CREEK IMPROVEMENTS FROM MIDDLEFIELD ROAD TO PARK BOULEVARD

Palo Alto, California

Prepared for

Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, California 95118

97 South Second Street
Suite 200
San Jose, CA 95113
(408) 297-9585

Woodward-Clyde Consultants

March 17, 1988

Project 8810070-R

Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, CA 95118

Attention: Mr. James M. Fiedler, Design Division Engineer

Gentlemen:

In accordance with our contract for professional services, we have completed the geotechnical investigation for the Matadero Creek Improvements project from Middlefield Road to Park Boulevard, in Palo Alto, California. We have met with your staff on two occasions during this investigation to coordinate design recommendations.

The accompanying report presents our engineering opinions and recommendations regarding the geotechnical factors influencing the design and construction of the proposed floodwalls and other channel improvements. The opinions and recommendations have been based upon the results of a field investigation, including 8 borings, laboratory testing, and upon engineering judgement and local experience. We have incorporated your review comments since the draft form of the report was issued on December 15, 1988. Ms. Maureen Fossum, Senior Staff Engineer, assisted in the investigation and preparation of this report.

We are pleased to have been of service to you on this project. If any questions should arise, please contact our office.

Sincerely,

Michael L. Larson

Michael L. Larson
Senior Project Engineer

William A. Bischoff
Vice President

MLL/WAB/rm

Attachment

Consulting Engineers, Geologists
and Environmental Scientists

Offices in Other Principal Cities

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GEOTECHNICAL INVESTIGATION
MATADERO CREEK IMPROVEMENTS
MIDDLEFIELD ROAD TO PARK BOULEVARD
Palo Alto, California

INTRODUCTION

This report presents the results of a geotechnical investigation conducted by Woodward-Clyde Consultants (WCC) in order to provide recommendations for the floodwalls which are to be erected along the improved Matadero Creek channel between Middlefield Road and Park Boulevard in Palo Alto, California. The report also covers the new U-frame channel which is to be installed between approximately Alma Street and Park Boulevard. The improvements also include widening and deepening of the channel between approximately Stations 153+62 and 158+70, corresponding to the reach between Cowper Street (upstream) and Waverly Street (downstream).

The investigation was done in conjunction with three other bridge geotechnical investigations performed at street intersections of Matadero Creek, and the culvert replacement for the Southern Pacific Railroad crossing just southwest of Alma Street. Except for the latter investigation performed by CH2M Hill, the other Matadero Creek investigations were performed by WCC, which were bridge replacement investigations at Middlefield Road, Cowper Street, Waverly Street and Bryant Street. Information gathered during these investigations was also considered, where relevant, in establishing the design recommendations for the floodwalls.

SCOPE

The geotechnical investigation was performed in order to explore the subsurface soil and groundwater conditions along the project alignment, to estimate the engineering properties of the soil materials encountered, and to develop recommendations for geotechnical aspects of the project design and construction. Specifically, the scope of services performed includes development of recommendations for the following:

- Type, depth and design parameters for floodwall and U-frame channel foundations;

- Lateral earth pressures for design of floodwalls, U-frame channel, and sloped side channel design;
- Resistance to lateral loads;
- Preliminary assessment of the potential for earthquake-induced soil liquefaction
- Earthwork recommendations for cut and/or fill areas including slope inclinations, excavation characteristics, shoring concepts and site preparation for filling;
- Suitability of on-site materials for use as backfill;
- Applicability of Santa Clara Valley Water District's standard details for drains and weep holes;
- Stability of unshored slopes during construction.

PROJECT DESCRIPTION

The proposed floodwalls and U-frame channel section are part of the (Santa Clara Valley Water District's (SCVWD) plan to improve the capacity of and widen the existing Matadero Creek in conjunction with the regional flood control program.

The proposed improvements are shown on two sets of drawings provided by the SCVWD. The first set, consisting of sheets 7 through 10 of the "Matadero Creek General Plan, Flood Basin to Foothill Expressway" are dated September 18, 1987 and include plan and profile. A second untitled preliminary set of drawings dated November 3, 1988, shows existing cross sections, including location of the 60 KV lines and 12 inch sanitary sewer, at specific station locations. The second set also shows the revised widened channel section between Cowper Street and Waverly Street.

Floodwalls Only

The new floodwalls will add approximately 3 to 4-1/2 feet in height to the existing concrete-lined channel. They will be placed near the top of the concrete lining in two areas, including between Station 142+67 (Middlefield Road) to 152+85 (Cowper Street), and between Station 158+75 (Waverly Street) to Station 175+45 (Alma Street). Foundation support provided by strip footings and by drilled piers spaced on ten-foot centers are under consideration. In most cases, the existing concrete lining terminates on the side slope at a depth of about 1 to 2 feet below the adjacent ground surface (hinge point). It is understood the new floodwalls will be positioned near the hinge point of the slope. On that basis, the floodwalls will have about 2 feet of grade differential from one side to the other, resulting in a differential exterior height of about 1 to 2-1/2 feet. A horizontal concrete slab will be placed between the top of the existing concrete lining and the new floodwalls. The existing trapezoidal shaped channel cross section is about 7 to 10 feet deep.

Replaced Channel Section

Between Cowper Street and Waverly Street, the existing concrete lining will be removed, the northwest side widened, and the new section replaced with a concrete lining for full width. Within this reach, the channel bottom will be partially deepened by as much as 1 foot 4 inches. A new vertical floodwall will then extend from the top of both sloped channel sides. The floodwall and lining will be structurally connected.

U-Frame Section

The reinforced concrete U-frame section will be placed in the new section of channel which is to be rerouted, namely from Stations 177+00 to 183+30, between Alma Street and Park Boulevard. This section will be about 15 feet deep and about 25 feet wide. Channel walls will extend as much as 2 feet above the adjacent grade level. The existing channel in this area will be backfilled and abandoned.

Existing Utilities

Of particular concern for the design and construction of the creek improvements are the existence of a 12-inch sanitary sewer and two conduits carrying 60KV of electricity located on the northwest side of the existing channel between Middlefield Road and Alma Street. The 60 KV electrical conduits then pass under the channel and tie into the Palo Alto Substation. These lines supply a major portion of the City's and Stanford University's electrical power and are to be maintained in operation during construction. They are reportedly very sensitive to any movement or changes in density of the sand bedding or surrounding soils. Oil is continuously pumped and circulated through the two 5/16-inch thick, 8 to 10 inch diameter steel pipes to dissipate heat generated from the electrical lines. It is understood a minimum distance of 2 feet must be maintained between any new structure and the edge of the sand filled trench containing the two electrical conduits. Based on this requirement, the floodwall on the northwest bank will have to be positioned as follows:

- Between Middlefield Road and Cowper Street, the estimated horizontal distance between top of channel lining and back of new floodwall is 2-1/2 to 3 feet
- Between Waverly Street and Alma Street, the estimated horizontal distance between top of channel lining and back of new floodwall is 3-1/2 to 6 feet

SITE AND SUBSURFACE CONDITIONS

Site Conditions

The site of the proposed creek improvements is located within the right-of-way of the existing Matadero Creek. At the time of our site visit in August 1988, water was observed in the creek channel and was estimated to be about 1 foot deep. The existing channel has concrete-lined side slopes, with a 1-1/2 to 1 (horizontal to vertical) pitch. Slopes typically continue to rise another 1 to 2 feet above the concrete lining before levelling off. In some cases, this rise is paved with asphalt concrete. A chain link fence extends along both sides of the right-of-way. The SCVWD's fenced right-of-way typically extends 6 to 8 feet from the top of the concrete channel lining on the southeast creek bank. An unpaved access road which is 12 to 15 feet wide, is maintained on the northwest side of the creek. The southeast side has very limited access. There is a 3-1/2 foot wide gate in the chain link fence on the southeast side at Middlefield Road. No access is provided between Cowper and Alma Streets.

Subsurface Soil Conditions

The subsurface soil and groundwater conditions at the project site were evaluated by examining existing subsurface information in the area (as shown in Appendix B), supplemented by 8 exploratory borings made specifically for this project. Data was thereby obtained at the following locations:

- Middlefield Road Bridge (2 borings), WCC Project 8715014-R
- Borings B-1 and B-2, drilled for this project between Middlefield Road and Cowper Street on the northwest creek bank
- Cowper Street Bridge (2 borings), WCC Project 8815021-R
- Boring B-3, drilled for this project between Cowper and Waverley Streets on the northwest creek bank
- Boring B-5, drilled for this project at the end of Kipling Street on the northwest side of the creek
- Waverley Street Bridge (2 borings), WCC Project 8815021-R
- Boring B-4, drilled for this project on the southeast creek bank at South Court
- Bryant Street Bike Bridge (2 borings), WCC Project 16119-V
- Boring B-6, drilled for this project on the southeast creek bank at Emerson Street
- Proposed Box Culvert just southwest of Alma Street (2 borings), data furnished by the SCVWD from CH2M Hill
- Borings B-7 and B-8, drilled for this project on the north creek bank between Alma Street and Park Boulevard

Sandy clay fill was typically encountered at the surface of the borings drilled closest to the creek bank. The fill was usually about 2-1/2 to 3 feet thick and appeared moderately well compacted. On the southeast bank of Waverley Street, fill was reported at about 11 feet below grade. At Middlefield Road, the fill was clayey sand to a maximum depth of 6 feet.

The fill material was generally underlain by very stiff to hard silty clays of high plasticity to depths ranging from 5 to 8 feet along most of the alignment; however, the clay was found in the 2 borings made at Park Boulevard to depths of 9 to 11 feet below grade. These clays are considered to have a moderate to high potential for expansion and to be slightly compressible. The alluvial deposits encountered below the near surface clays were composed of alternating layers of relatively granular and cohesive deposits. Most of the granular material was found between approximately 8 and 15 feet below grade on the downstream side (northeast) of Alma Street.

The borings made upstream (southwest) of Alma Street generally encountered clayey material at depths shallower than 25 feet. Only thin layers of clayey sand and silty sand were encountered at depths of about 15 feet in upstream Borings 7 and MB-2. The clays encountered are medium stiff to stiff in consistency and the sandy to gravelly materials are medium dense in relative density. These deposits are considered to be of moderate strength.

An OVA (Organic Vapor Analyzer) was used during the drilling operations conducted for this project. Prior to the field operations, WCC and CH2M Hill staff discussed the location and extent of nearby groundwater contaminants. Existing available information indicated relatively low levels of volatile organic compounds are present in groundwater several hundred feet downgradient of the proposed drilling sites. Reportedly, these contaminated groundwaters are being pumped to and diluted by Matadero Creek flows within a few hundred feet downgradient of the drilling sites. Because detectable levels of volatile organic compounds are present in the vicinity of the Matadero Creek Improvements project site, it was decided that the use of the OVA during the drilling operations would provide the opportunity to conduct a safe shutdown of operations, had hazardous contaminant levels been present. In fact, no detectable levels of organic vapors were found in the borings, with the single exception of 1.5 ppm logged in the field with the OVA in a sample from Boring 4 taken from a depth of 16-1/2 feet below grade level.

More detailed descriptions of the soil and groundwater conditions encountered in the exploratory borings are presented on the Logs of Borings, Figures 3 through 10. Also included in Appendix B are Logs of Borings made for other nearby projects as discussed above.

Groundwater

Groundwater was encountered in borings at variable depths below ground surface along the project as follows:

- Between Middlefield Road and Cowper Street, between 11 to 15 feet and was observed to rise to about 9 to 10-1/2 feet upon completion of drilling

- Between South Court and Emerson Street, between 11-1/2 to 14-1/2 feet and was observed to rise to about 11 to 12 feet upon completion of drilling
- Between Alma Street and Park Boulevard, between 15 to 16-1/2 feet at time of drilling

In other areas with unreported water levels, borings were advanced using the rotary drilling method which does not allow measurement of the groundwater level during drilling. In borings with measured water levels, groundwater was encountered in layers of sand and gravel. An exception to this was Boring MB-2.

Groundwater levels may vary considerably with seasonal rainfall or fluctuations of water level in Matadero Creek.

DISCUSSION

The subsurface conditions along the project alignment can be described as shallow fill underlain by predominantly cohesive alluvial deposits with some clayey sand and sandy clay interbeds. The near surface clays are very stiff to hard in consistency and are moderately to highly expansive. Between Middlefield Road and Alma Street, there is generally a layer of sand and gravel between depths of 8 to 15 feet. Underlying clay layers are of moderate strength and compressibility. Considering these subsurface soil conditions, it appears that continuous strip footings are a viable method of foundation support. However, in some sections of the channel, a continuous strip footing may interfere with the existing utilities (sanitary sewer and electrical conduits in the northwest bank). As an alternative, shallow drilled piers can be used to support the new floodwall system.

In the following report sections, recommendations are presented regarding (1) the foundation design and installation of continuous strip footings and drilled piers; (2) geotechnical considerations of the U-frame channel section; and (3) other geotechnical aspects of the project design and construction.

RECOMMENDATIONS

Foundation Support - Vertical Floodwalls

Continuous Strip Footings -

Design Pressures - It is recommended that the proposed new vertical floodwalls be supported on continuous strip footing foundations extending to a minimum depth of 3 feet below the lowest adjacent finished grade. The footings should be situated on native soil. The 3 foot depth is recommended to minimize swell pressures exerted by the expansive native clays. As a precautionary measure, it is recommended that longitudinal steel reinforcement be placed in the top and bottom of panels. In the event that cracking occurs, the panels will be tied together by the steel reinforcement. In any event, footings should not be situated in utility trench backfill (such as for the existing sewer). This requirement may preclude the use of continuous footings in some areas. A minimum distance of 2 feet should be maintained between the wall footing and the edge of the sand filled trench containing the two electrical conduits. Footing design pressure should not exceed 1,800 pounds per square foot (psf).

Depending on structural considerations, it may be feasible to precast concrete panels and set them in shallow trenches, as shown in Figure 11. The annular space between panel and trench walls should be backfilled with a soil cement slurry with a minimum seven day compressive strength of 100 psi. Trench excavation, panel placement, and slurry backfill should be accomplished in the same day to prevent trench cave-in.

Lateral Load Resistance - Resistance for flood conditions will be developed by passive earth pressure against the embedded side of the wall. A passive equivalent fluid pressure of 200 pcf should be assumed to act against the exterior side (outside of the channel), for walls that can deflect about 1/2 inch. If it is desireable to reduce wall deflection to negligible amounts, the resisting equivalent lateral soil pressure should not exceed 60 pcf. Considering the close proximity of the sloping channel side, the soil pressure on the interior side (inside of the channel) should be neglected.

Drilled Pier Foundations - As an alternative, the proposed vertical floodwalls can be supported on drilled pier foundations, as shown in Figure 12.

Design Pressures - Where piers are used, they can be used to resist downward loads. Pier design capacity will be developed through side friction only. End bearing should be neglected. The recommended design skin friction is 400 psf. The upper 1 foot of the pier should be neglected when calculating frictional pier design capacity.

All piers should have a minimum shaft diameter of 16 inches, and a maximum shaft diameter of 24 inches. Considering that groundwater will be encountered at depths of about 10 feet between Alma Street and Middlefield Road, and that granular soils are anticipated between depths of about 8 to 15 feet, it would appear prudent to maintain the design depth above 10 feet below existing grade. Construction in the dry periods of the year would be desireable, to minimize the potential for higher groundwater levels and cave-in in the granular materials. Minimum recommended pier depth should be 6 feet. This dimension will allow placement of the bearing load below the zone of seasonal volume change.

Reinforced concrete grade-beams could be employed to provide a structural connection between the floodwalls and drilled pier foundations. Alternatively, the floodwall could consist of precast concrete panels placed on drilled piers, as shown in Figure 12. Please note that a void shown under the panel will allow some seasonal swelling of the native soils without causing uplift pressures on the base of the floodwall panel.

Lateral Load Resistance - Drilled piers will have the ability to resist horizontal forces. The recommended ultimate horizontal pressure for the piers is as follows:

- 200 pcf of depth for ground line level on both sides of the pier, to a horizontal distance equal to two times the pier depth

- 50 pcf of depth for ground line level on one side of the wall and sloped downward at 1-1/2 to 1 (horizontal to vertical) on the opposite (channel) side

These values are intended for use with the design procedures presented in Section 2907 of the UBC, latest edition.

Foundation Support - Replaced Channel Section -

General - This reach, which extends between Cowper Street and Waverly Street, will be widened, deepened, and replaced with new lining, including new floodwalls. The floodwalls for this reach could be supported on either continuous strip footings or drilled piers, as discussed previously. However, the location of the existing sewer on the northwest bank may preclude either type of these foundations.

Structural Slab - As an alternative, the new slab, including bottom, side slopes and floodwalls, could be structurally designed to act as a large "slab spread footing". For "slab spread footing" foundations placed on native soil or new compacted fill, the design bearing pressure should not exceed 1,800 psf. However, the supporting capacity of the soil overlying the sanitary sewer trench backfill on the northwest bank should be neglected. This will require additional steel reinforcement to span the trench.

It is expected that most of the side slopes will consist of moderately to highly expansive clays. The potential for swelling, and the limits of the swelling are a function of many unknown factors, such as extent of drying and location of clays. As a precautionary measure to minimize structural distress to the slab due to seasonal volume changes in the expansive clay soils, consideration should be given to provide additional steel reinforcement in the sloped side slabs, beyond that normally required.

Side Slopes - It is recommended that permanent side slopes for the channel be sloped no steeper than 1-1/2 to 1 (horizontal to vertical).

Foundation Support - U-Frame Section

General - This reach, which extends between Alma Street and Park Boulevard, will either be supported on two separate continuous wall footings or on the channel bottom slab which extends for full width across the channel. The latter is similar to a mat foundation.

Spread Footings or Mat - For either type of foundation situated on native clay or clayey sand material about 15 feet below present ground surface, a maximum design pressure of 2,500 psf is recommended.

Lateral Load Resistance - Resistance will be developed by both friction at the base of the footing/slab and passive earth pressure against its side. A design coefficient of friction of 0.30 can be assumed at the footing base. If additional resistance to siding is required, a passive equivalent fluid pressure of 200 pcf should be assumed to act against the exterior side (outside of the channel), for 15 foot high walls that can deflect about 3 inches. If it is desireable to reduce wall deflection to negligible amounts, the resisting equivalent lateral soil pressure should not exceed 60 pcf.

Design Earth Pressures

General - Floodwalls, U-frame channel walls and sloped side channel walls should be designed to resist static lateral earth pressures imposed by the adjacent backfill.

U-Frame Channel Walls - For horizontal backfill conditions, walls that are free to deflect at the top should be designed to resist an equivalent fluid pressure of 40 pcf. For walls which are restrained from movement at the top, an equivalent fluid pressure of 60 pcf corresponding to the "at-rest" condition should be used for design. Surcharge loads such as vehicular traffic would apply additional loads to the walls. For design purposes, a surcharge pressure equivalent to 2 feet of soil should be applied to account for traffic loads.

The wall pressures recommended above are based on the assumption that no differential hydrostatic pressures will develop behind the retaining walls. The buildup of hydrostatic pressures behind the wall should be prevented by the inclusion of an adequate positive drainage system such as that described in the SCVWD's Details for Adobe Creek drains and weep holes. However, the permeable material behind the vertical U-frame sidewalls should extend to a height of no more than 3 feet below finished grade.

Alternatively, walls could be designed to resist hydrostatic and soil pressures. In this case, compacted select fill could be placed behind the retaining walls and weep holes/drains could be deleted. For this alternative, walls that are free to deflect at the top and which will resist hydrostatic pressures should be designed to resist an equivalent fluid pressure of 85 pcf. For walls which are restrained from movement at the top and which will resist hydrostatic pressures, an equivalent fluid pressure of 95 pcf corresponding to the "at-rest" conditions should be used for design. For these two alternatives, walls should also be designed for the surcharge traffic loads recommended above.

Expansive fat clay soils were encountered to a depth of about 10 feet in this area. It is recommended that either (1) additional reinforcing steel be placed in the walls to full height to account for additional expansive pressure, or (2) the expansive clays be replaced by granular non-expansive soils to a width at least 4 feet behind the walls. During construction, the exposed face of expansive clays on cut slopes should be periodically moistened to minimize post-construction expansion against the walls.

From about Station 177+00 to Station 181+00, the new channel alignment will parallel three railroad tracks. The distance between the closest channel wall and the centerline of the first set of railroad tracks is about 25 feet. Based on an analysis of these geometrics and for an E-72 Cooper Railroad Live Load surcharge, it is recommended that the vertical wall closest to the railroad tracks also be designed for an additional uniform load of 72 psf for the full wall height.

In the vicinity of about Station 181+00 to 182+00, the existing channel will be backfilled. At this location, the old channel is next to the new channel. During construction, the new U-frame walls in this area will be subjected to increased horizontal stresses due to the loads imposed by the Contractor's compaction equipment when he backfills the old channel section. It is anticipated that the Contractor will use self propelled vibratory compactors in combination with hand operated "wacker" type equipment to compact the backfill material. In order to account for this loading condition, a Bomag Model BW172D single-drum vibratory roller has been assumed to be representative of the type of compactor likely to be used. This model compactor has a gross weight of approximately 12,500 pounds and measures roughly 5-1/2 feet wide by 15 feet long. The vibrating drum can operate with a centrifugal force of up to 26,000 pounds. It is recommended that the proposed U-frame retaining walls in this area be design for the following horizontal pressure distribution to account for this type of compaction equipment loading. The horizontal pressure should increase linearly from zero at the top of the wall to 700 pounds per square foot at a depth of 1-1/2 feet and then continue vertically down the wall at the 700 pounds per square foot level until this surcharge pressure intersects with the static earth pressure diagram. This is a temporary load condition that will act in addition to the recommended static earth pressure presented in the earlier paragraphs of this report. If heavier compaction equipment is to be used, it is recommended that the Engineer review the proposed fill placement and compaction procedures to determine if the wall design must be modified or constraints must be applied on the operation of the compaction equipment adjacent to the wall.

Vertical Floodwalls - During normal flow, the water level in the channel will be several feet below the bottom of the new floodwalls. For this condition, the channel walls should be designed to resist static lateral earth pressures imposed by the differential grade elevations. For horizontal grade conditions, walls that are free to deflect near the top should be designed to resist an equivalent fluid pressure of 40 pcf. For walls which are restrained from movement near the top, an equivalent fluid pressure of 60 pcf corresponding to the "at-rest" condition should be used for design. Surcharge loads such as vehicular traffic would apply additional loads to the walls. For design purposes, a surcharge pressure equivalent to 2 feet of soil should be applied to account for traffic loads, where applicable.

Sloped Channel Sidewalls - For the channel reach between Cowper Street and Waverly Street, where the side slopes are 1-1/2 to 1 (horizontal to vertical), the new slab placed on the side slopes should be designed to resist an equivalent soil fluid pressure of 10 pcf, with a direction placed normal to the underside of the slab.

This recommended pressure is based on the assumption that no differential hydrostatic pressure will develop behind the sidewalls. The build-up of hydrostatic pressures behind the wall should be prevented by the inclusion of an adequate positive underdrain system.

Liquefaction

Soil liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. For this project site, the subsurface soils encountered within the depths of borings include clayey and sandy materials. The sandy layers were generally found to have a medium to high relative density, indicative of soil with only a slight susceptibility to liquefaction. However, numerous gradational and occasional sandy layers were encountered below the groundwater level. It is conceivable that these sandy deposits may liquefy in the event of a strong earthquake. The discontinuous nature of these sand layers and lenses and the presence of relatively thick cohesive deposits above them suggests that the potential for ground rupture due to liquefaction is considered to be remote.

Scour/Erosion Considerations

The side slopes and bottom of the existing and improved creek flow channel will be concrete lined. If the connection between floodwalls and channel side slopes is covered by means of a continuous concrete apron then protection against scour or erosion along the channel is provided.

Construction Considerations

Construction Slopes - Construction slopes 10 feet high or less are estimated to stand temporarily at an inclination of 1 to 1 (horizontal to vertical) in the native soils encountered in the exploratory borings. If cut slopes exceed 10 feet in height, it is recommended that they be inclined no steeper than 1-1/2 to 1 (horizontal to vertical). In the event excavations are made near residences, the excavation face (at the footing level) should be offset at least 5 feet horizontally before the previously recommended side slopes are cut. If this criterion cannot be met, shoring would be required.

Shoring - A shoring system will be necessary to construct the U-frame channel walls to maintain traffic flow, to retain the existing electrical conduits, to avoid excavation encroachment onto adjacent property, or for protection of the existing railroad tracks. In particular, shoring is recommended for channel construction between Alma Street and Park Boulevard where the channel abuts property owned by others, and the transition next to the railroad. Extreme care should be taken to avoid damaging the existing buried 60 KV electrical conduits in this area which run underneath the channel. Similarly, sheeting may be required for this excavation, if sloping sides encroach on the railroad property. Selection of the shoring system is usually the responsibility of the Contractor. Furthermore, selection of the lateral earth pressures and traffic loads used in his shoring design would be also his responsibility. Soldier beams and lagging or steel sheeting are commonly used shoring systems in this area. If soldier beams are used, they should be installed in predrilled holes filled with lean concrete. Because of the inherent flexibility of these systems, it should be recognized that some settlement of the surrounding ground surface is anticipated. Any voids created between the lagging or shoring and the native soils should be properly filled to minimize soil loss. It is recommended that the Engineer review the Contractor's shoring plan prior to construction.

Existing Electrical Conduits - The two existing 60 KV electrical conduits located on the northwest side of the channel are to be maintained in operation during construction. Reportedly, operation of these lines is sensitive to change in density of the sand bedding and surrounding soils. Therefore, the effect of construction activities is of major concern. The following measures are recommended to minimize potential disruptions of the electrical lines.

As required by the City of Palo Alto, a minimum distance of 2 feet must be maintained between any new structure and the edge of the sand filled trench containing the two electrical conduits. Obviously, the new floodwall should not be positioned over the electrical lines.

It is recommended that the electrical conduits be accurately located by hand-digging as necessary to confirm instrumentation-provided locations. During excavation (for footing or drilled piers) along the northwest side of the channel, a full time observer should be provided to observe the excavation. Contingency plans should be prepared in the event that the electrical conduits are found to be within the construction zone.

In the reach between Cowper Street and Waverly Street, the excavation for the new side slope will be in close proximity to the electrical conduit trench. In this area, the Contractor should install a permanent shoring system to restrain the electrical conduits. The shoring system should be designed and constructed as a "rigid" system to minimize movement of soil underneath the conduits. The specifications should be written accordingly.

Other Utilities - Sanitary sewers, telephone lines, storm drains, natural gas pipelines and water supply pipelines are located in the creek vicinity at various locations along the project route. In particular, a 12-inch diameter concrete sanitary sewer is located 2 to 5 feet from the edge of the existing channel lining along the northwest creek bank. All utilities should be accurately located in the field prior to construction and contingency plans made to accommodate unanticipated conditions. It may, for example, be necessary to either relocate the sanitary sewer line discussed above at certain locations or to implement an alternative floodwall foundation scheme in areas of interference.

Bottom Heave - This type of failure occurs in soft clays when the bearing pressure on the sides of the excavation exceeds the bearing capacity of the soil at the base of the excavation. A failure of this type results in bottom upheaval and settlements of the surrounding ground surface which may damage existing nearby structures. Based on our analysis, bottom heave is not anticipated for excavations 15 feet deep or less.

Dewatering - As discussed previously under "Site and Subsurface Conditions", groundwater is expected at depths from 9 to 15 feet. About 1 foot of water was observed flowing in the channel bottom during our site visit in August 1988.

If excavations for U-frame channel construction extend to a depth of about 15 feet, dewatering may be needed to control groundwater and surface water so that backfilling can be done in the dry. It is anticipated, based on soil borings made in the area, that the base of the excavation will penetrate principally sandy clay or clayey sand. Considering these conditions, it is conceivable that a temporary earth cofferdam could be used to divert stream flow and that the interception and removal of seepage into the excavation might be accomplished using a system of sump pits and pumps. The final selection of the dewatering system is the responsibility of the Contractor. However, it is recommended that the Contractor submit his proposed dewatering system scheme for review by the Engineer prior to installation.

Groundwater is also anticipated near the bottom of the deepened excavation to be made for the replaced channel section between Cowper Street and Waverly Street. Similar recommendations for dewatering are made as given previously for the U-frame channel section.

If a continuous strip footing is selected for the new floodwalls between Middlefield Road and Alma Street, the base will be at least 5 feet above groundwater. Dewatering is not anticipated for this excavation.

Site Preparation and Grading

Heavy construction machinery should not be allowed to operate on the base of excavations made to depths greater than the natural water table. This includes the reaches between Cowper Street and Waverly Street, and between Alma Street and Park Boulevard. This precaution is recommended because of the potentially spongy or pumping subgrade conditions which can be anticipated in soils of moderate to high natural moisture contents.

All grading and backfilling should be done under the direct observation of the Engineer.

Site Preparation - Before any grading begins, it is recommended that the surface of the site be cleared of all debris and rubble. Between Cowper Street and Waverly

Street, the existing concrete lining should be removed for the full channel width. It is recommended that the excavated areas be left in an unbackfilled condition to allow for ease of location and proper backfilling. Any organic laden soils should be stripped. Final stripping depths and general site preparation should be approved by the Engineer at the time of grading. After the clearing has been completed, any soft or loose material on the site surface should be excavated and removed. All existing fill material encountered within the U-frame section area should be excavated and removed. The Grading Contractor should obtain the Engineer's approval of the rubble and loose material removal prior to proceeding with any further grading.

Subgrade Preparation -

General - Excavation for the U-frame section and trapezoidal section is expected to extend into moderate strength clay or sand deposits. The sand or clay at the base of the channel excavation is expected to be unable to support construction traffic. Disturbance of these materials during construction could lead to substantially large settlements. To minimize disturbance, it is recommended that the last 2 feet of excavation be made by equipment supported above this level. This might be accomplished with a backhoe excavating from locations at least 2 feet above final subgrade or with a backhoe from outside the excavation. If the Contractor does not follow this recommendation, the subgrade should be overexcavated to a depth of 2 feet and replaced with a layer of geotextile bridging fabric and a 2 foot section of bridging rock to bridge the soft disturbed sugrade. Bridging rock for placement on top of geotextile bridging fabric shall consist of clean, hard, durable rock with the following grading requirements:

Sieve Size	Percentage Passing Sieve
6"	100
2"	0 - 50
3/4"	0 - 10

Opinions regarding the need for bridging rock should be obtained from the Engineer at the time of grading.

Fill Material - The existing native and fill material can be reused as engineered fill provided it is free of organic material, rubble, and debris. Expansive clay materials with a plasticity index of 15 or more should not be placed within 4 feet of any structural element. The fill material shall not contain rocks or lumps over 6 inches in greatest dimension, and not more than 15 percent larger than 2-1/2 inches. All import material should be a low plasticity material with a plasticity index of 15 or less.

Placing and Compacting Fill - All engineered fill and structural backfill should be placed in lifts not exceeding 8 inches in uncompacted thickness and should be compacted to a minimum degree of compaction of 90 percent. Pavement subgrade and aggregate base placed as part of the pavement structural section should be compacted to a minimum degree of compaction of 95 percent. Final subgrade compaction should be accomplished immediately prior to placement of aggregate base. Degree of compaction is the ratio of the in-place density of constructed fill to the maximum dry density determined by California Test Method No. 216-F, as described in the Caltrans Materials Manual, 1973 edition. In -place density is the dry density of the constructed fill determined in accordance with the moisture-density gauge method, ASTM Designation: D2922-71.

LIMITATIONS

The opinions, conclusions and recommendations contained in this report are based on the assumption that the soil conditions do not deviate appreciably from the conditions encountered in the borings. They are also based upon our site reconnaissance, review of available data and topographic information, and upon local experience and engineering judgment.

The elevations of the exploratory borings are based on interpretation of plan and profile drawings provided by others, or provided by the Santa Clara Valley Water District, or by field observations. The elevations of the top of the slab (existing or proposed) in the bottom of the channel are based on interpretation of plan and profile drawings provided by the Santa Clara Valley Water District.

If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that planned at the present time, the Geotechnical Engineer should be notified so that supplementary recommendations can be made. It is recommended that the Geotechnical Engineer review the plans and specifications prior to construction. Geotechnical issues may arise during construction which are not apparent at this time. The Geotechnical Engineer should be retained during construction to review the soil conditions encountered and the construction procedures. All pier foundation installation should be done under the direct observation of the Geotechnical Engineer.

The recommendations presented in this report were developed with the standard of care commonly used as state of the practice in the profession. No other warranties are included, either expressed or implied, as to the professional advice included in this report.

APPENDIX A

APPENDIX A
FIELD EXPLORATION AND LABORATORY TESTS
MATADERO CREEK IMPROVEMENTS
MIDDLEFIELD ROAD TO PARK BOULEVARD
Palo Alto, California

FIELD EXPLORATION

Eight (8) exploratory borings were made for this investigation. The approximate boring locations are shown on the Site and Boring Location Plan, Figure 1. Both rotary drilling methods and flight augers were used to advance the borings to depths from 6-1/2 to 40 feet. Borings 5, 7 and 8 were drilled on August 18, 1988 using a Failing 1500 rotary drill rig. The remainder of the borings were drilled with a Mobile Skid-mounted auger rig on August 3, 4 and 5, 1988. All of the drilling was conducted under the supervision of a representative of Woodward-Clyde Consultants. Soils were visually classified in the field. Samples of the underlying soils were obtained using one of the following samplers:

- Modified California Sampler (2 inch I.D. and 2-1/2 inch O.D.); and/or Standard Split-Spoon Sampler (1-3/8 inch I.D. and 2 inch O.D.), driven 18 inches into the soil with a 140-pound hammer free falling 30 inches with blow counts recorded for the last 12 inches of penetration
- Shelby Tube Sampler (nominal 3 inch diameter) pushed into the soil using hydraulic pressure

When the sampler was withdrawn from the hole, the brass tubes containing the samples were carefully removed, sealed to preserve the moisture content and returned to the laboratory for testing.

In addition, the samples retrieved from the soil borings were monitored in the field for detectable levels of organic vapors using a Century Organic Vapor Analyzer.

The type of sampler used at each depth is shown on the Logs of Borings in accordance with the symbols explained on the Boring Log Legend Sheet, Figure 2.

Field classifications of soil samples were verified by further examination and testing in the laboratory. The Logs of Borings made for this investigation are presented as Figures 3 through 10.

LABORATORY TESTS

The water content, dry density, and unconfined compressive strength were determined for selected samples to estimate the strength and compressibility of the underlying soils. The results of these tests together with the resistance to penetration of the sampler are shown at the corresponding sample locations of the Logs of Borings.

APPENDIX B

APPENDIX B

BORING LOGS FROM PREVIOUS INVESTIGATIONS

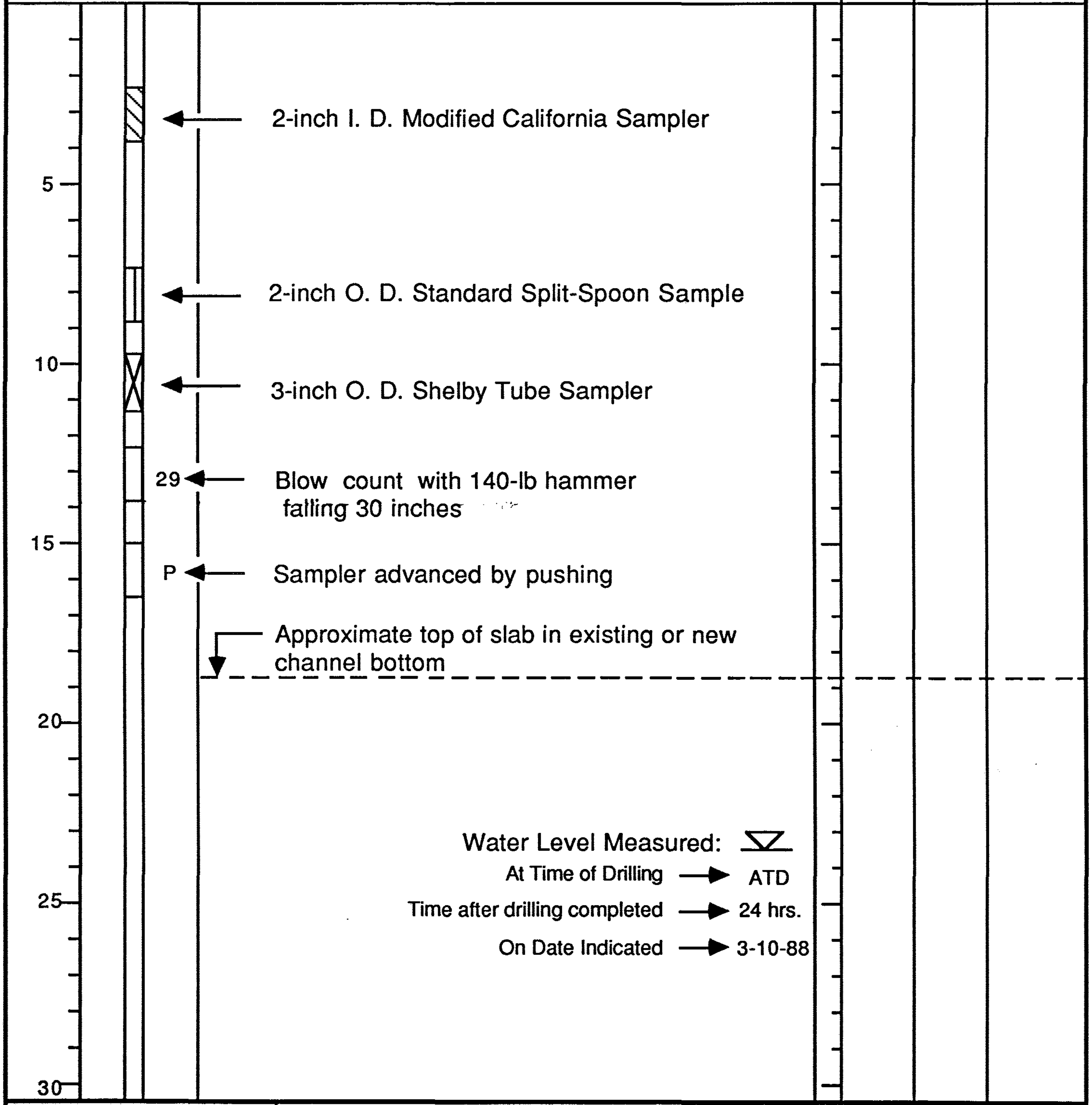
Project: MATADERO CREEK FLOODWALLS
Palo Alto, California

Boring Log Legend Sheet

Date Drilled:
Type of Boring:
Hammer:

Remarks:

Depth Ft.	Samples	Blows/Ft	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compress. Strength, psf
			Surface Elevation:			



2-inch I. D. Modified California Sampler

2-inch O. D. Standard Split-Spoon Sample

3-inch O. D. Shelby Tube Sampler

Blow count with 140-lb hammer falling 30 inches

Sampler advanced by pushing

Approximate top of slab in existing or new channel bottom

Water Level Measured: ∇

At Time of Drilling → ATD

Time after drilling completed → 24 hrs.

On Date Indicated → 3-10-88

Project: 8810070-R | **Woodward-Clyde Consultants** | Figure 2

Project : MATADERO CREEK BRIDGES
Palo Alto, California

Log of Boring No. 1

Date Drilled: August 27, 1987
Type of Boring: 8-inch Hollow Stem
Hammer: 140 lbs

Remarks: SW Corner at Matadero Creek and Middlefield Road

Surface Elevation: 16 ±

Depth Ft.	Samples	Blows/Ft	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compress. Strength, psf
	1	6	CLAYEY SAND FILL (SC-CL) Poorly compacted, damp, brown with gravel up to 1/2 inch diameter (Fill)	9	105	3500
5	2	13	SILTY CLAY (CH) Very stiff, moist, dark brown to black with some gray less plastic zones and with trace of 3/4 inch gravel	27	95	5550
10			CLAYEY SAND (SC-CL) Loose to medium dense, moist, olive gray with gravel up to 1 inch diameter ▽ After Drilling			
	3	11	SANDY GRAVEL (GM-GC) Loose to medium dense, brown and gray with some clay, and with gravel up to 1-1/2 inch diameter			
	4	20	▽ ATD	10	126	–
15	5	2	Cave-in			
	6	6	SANDY CLAY (CL) Medium, olive gray to light gray with some rust mottling			
20	7	4		28 27	95 95	1430 1120
25	8	13	SILTY SAND (SM) Medium dense, brown and gray and black and with gravel +#4 = 27% -#200 = 11%			
30			Cave-in			

Project: 8715014R

Woodward-Clyde Consultants

Figure 3a

Project : MATADERO CREEK BRIDGES
Palo Alto, California

Log of Boring No. 1
(Continued)

th Ft.	Samples	Blows/Ft	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compress. Strength, psf
	9	25	SILTY SAND (SM) ...... Continued			
35			SILTY CLAY (CL) Medium, gray with some light gray mottling			
	10	11		30	91	1700
40			BOTTOM OF BORING AT 40 FT			
5						
0						
55						
60						

roject: 8715014R | **Woodward-Clyde Consultants** | Figure 3b

Project : MATADERO CREEK BRIDGES
Palo Alto, California

Log of Boring No. 2

Date Drilled: August 21, 1987
Type of Boring: 8-inch Hollow Stem
Hammer: 140 lbs

Remarks: NE Corner at Matadero Creek and Middlefield Road

Surface Elevation: 15 ±

Depth Ft.	Samples	Blows/Ft	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compress. Strength, psf
			CLAYEY SAND FILL (SC) Poorly compacted, damp to moist, brown and gray, with clay seams and gravel up to 1/2 inch diameter			
	1	10		5	109	–
			(Fill)			
5						
	2	11	SILTY CLAY (CH) Stiff, moist, dark brown to black	32	85	2370
			CLAYEY SAND (SC-CL) Medium dense, very moist, olive gray to light brown-gray, and with gravel up to 1 inch diameter ▽ After Drilling			
10						
	3	29		17	115	1120
			CLAYEY GRAVEL (GC) Medium ~~dense,~~ ~~olive~~ gray and brown, with gravel up to 1 inch diameter and with some sand ▽ ATD			
15						
	4	24	} Silty clay lens, medium, gray and orange-brown mottled	17	113	240
20			SANDY CLAY (CL-SC) Soft to medium, olive gray to light gray with traces of gravel			
	5	11		27	95	980
			Cave-in at 25-ft			
25						
	6	26	SILTY SAND (SP-SM) Medium dense, brown and black with gravel up to 1/4 inch diameter +#4 = 18% -#200 = 8%			
30						

Project: 8715014R | **Woodward-Clyde Consultants** | Figure 4a

Project : MATADERO CREEK BRIDGES Palo Alto, California	Log of Boring No. 2 (Continued)

pth Ft.	Samples	Blows/Ft	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compress. Strength, psf
	7	43	SILTY SAND (SP-SM) ...... Continued Dense			
			SANDY CLAY (CL) Medium,olive gray to light gray with some pebbly sand and gravel up to 3/4 inch diameter			
35	8	17		23	102	1340
40	9	24	GRAVELLY SAND (SP) Medium dense, black Silty clay (CL-CH), stiff, dark gray brown			
			BOTTOM OF BORING AT 41-1/2 FT			
5						
0						
55						
60						

roject: 8715014R	Woodward-Clyde Consultants	Figure 4b

Project: MATADERO CREEK BRIDGES
Cowper Street, Palo Alto, California

Log of Boring No. 9

Date Drilled: August 15,1988
Type of Boring: Rotary Wash
Hammer: 140 lbs (unless noted)

Remarks: Cowper street, NW bank, east side of street
Location:

Depth Ft.	Samples	Blows/Ft	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compress. Strength, psf
			Surface Elevation: ± 18			
			4" ASPHALTIC CONCRETE 14" SUBGRADE			
	1	25 200 lb. hammer	SILTY CLAY (CL-CH) Very stiff, moist, dark brown, trace fine gravel, some roots	24	89	6600
5	2	45	Some gravel at 6 feet	17	108	3510
			SANDY CLAY (CL) Very stiff, moist, tan, some fine gravel, carbon rust staining			
10	3	51	Grading coarser	13	120	
			CLAYEY GRAVEL (GC) Dense, saturated, some sand, brown and gray, coarse gravel to 1-1/2" diameter			
15	4	37	Layers of medium sand			
			SILTY CLAY (CL) Medium stiff, moist, tan and brown, some fine sand, carbon staining			
20	5	11		31	91	1390
25	6	13	Grading coaser	25	99	1480
30	7	14	SILTY CLAY (CL) Stiff, moist, blue-gray and tan, very silty	37	80	95 disturbed
35	8	24	Occasional gravel Some fine to medium gravel	23	103	3100
40	9	15		27	96	2270

Project:8815021-R

Woodward-Clyde Consultants

Figure 3a

Project: MATADERO CREEK BRIDGES
Cowper Street, Palo Alto, California

Log of Boring No. 9

Depth Ft.	Samples	Blows/Ft	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compress. Strength, psf
			SILTY CLAY (CL) ...(CON'T)			
45	10	21	CLAYEY SILT (ML) Medium dense, moist, dark gray, some fine sand	29	95	840
50	11	25		26	97	1570
55	12	62	SAND (SW) Medium dense, damp, gray, well graded, medium to coarse grained, some gravel	18	107	
			SAND (SP) Dense, uniformly graded, gray, coarse to grained, some silt			
60	13	23		29	93	1081
			SANDY CLAY/CLAYEY SAND (CL/SC) Stiff, gray, fine grained sand with gravel to 1/8" diameter, lenses of medium grained, loose sand			
65	14	48		23	100	1080
70	15	42	SILTY CLAY (CL) Very stiff, gray, occasional gravel	21	106	4230
75	16	67	Gray and brown, hard	24	102	3810
80	17	43	Very stiff	27	98	3760

Project:8815021-R

Woodward-Clyde Consultants

Figure 3b

Project: MATADERO CREEK BRIDGES
Cowper Street, Palo Alto, California

Log of Boring No. 9

Depth Ft.	Samples	Blows/Ft	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compress. Strength, psf
	18 ▨	42	SILTY CLAY (CL)...CON'T	29	93	3710
			BOTTOM OF BORING AT 86-1/2 FEET			
90						
95						
100						
105						
110						
115						
120						
125						

Project:8815021-R	Woodward-Clyde Consultants	Figure 3c

Project: MATADERO CREEK BRIDGES
Cowper Street, Palo Alto, California

Log of Boring No.10

Date Drilled: August 17,1988
Type of Boring: Rotary Wash
Hammer: 140 lbs

Remarks: Cowper street, SE bank, west side of street

Location:

Surface Elevation: ± 18

Depth Ft.	Samples	Blows/Ft	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compress. Strength, psf
			4" ASPHALTIC CONCRETE 20" AGGREGATE BASE			
	1 ▨	35	SILTY CLAY (CL-CH) Stiff, damp, slighty moist, dark brown, ocasional fine gravel, occasional roots	23	90	5830
5						
	2 ▨	71		13	120	3120
10			GRAVELLY CLAY (CL) Stiff, damp, brown, gravel to 2" diameter			
	3 ▥	29				
15						
			SILTY CLAY (CL) Stiff, brown and tan some fine sand, carbon staining, carbonate deposits			
	4 ▨	20 NO RECOVERY				
20						
	5 ▨	11		30	91	2130
25						
	6 ▨	11		29	94	930
			↓ More sand			
30						
	7 ▨	19	↓ Gray and brown	28	94	1200
35						
				270	98	1990
			↓ Brown and tan, occasional fine gravel			
	8 ▨	25				
40						

Project:8815021-R

Woodward-Clyde Consultants

Figure4a

Project: MATADERO CREEK BRIDGES
Cowper Street, Palo Alto, California

Log of Boring No. 10

Depth Ft.	Samples	Blows/Ft	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compress. Strength, psf
	9 ▨	25	SILTY CLAY (CL) ...(CON'T) Grey and brown, carbonate deposits, lenses of Sandy Clay and Clayey Sand	25	99	2510
45			BOTTOM OF BORING AT 43-1/2 FEET			
50						
55						
60						
65						
70						
75						
80						

Project:8815021-R	Woodward-Clyde Consultants	Figure 4b

Project: MATADERO CREEK BRIDGES
Waverley Street , Palo Alto, California

Log of Boring No. 11

Date Drilled: August 16,1988
Type of Boring: Rotary Wash
Hammer: 140 lbs

Remarks: Waverley street, SE bank, east side of street
Location:

Depth Ft.	Samples	Blows/Ft	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compress. Strength, psf
			Surface Elevation: ± 22			
	1 ▨	59	GRAVELLY CLAY FILL (CL) Moderatey compacted, damp, brown, rootlets	11	112	11000
5						
	2 ▨	40				
10			(FILL) ↑			
	3 ▥	31	GRAVELLY SAND (SW) Medium dense, moist, reddish brown, coarse grained, gravel to 1/2" diameter			
15			SILTY CLAY (CL) Stiff, moist, brown with reddish brown Sandy Silt lenses			
	4 ▨	18	↓ Layers of reddish brown fine Sandy Silt	32	89	3430
20						
	5 ▥	69	SANDY GRAVEL (GP) Very dense, damp, brown and gray with lenses of reddish Silt, gap-graded, gravel to 3/4" diameter			
25						
	6 ▥	79				
30			SILTY CLAY (CL) Medium stiff, moist, brown and tan, trace of fine sand			
	7 ▨	22	↓ Becoming coarser with depth	25	99	1390
35						
	8 ▨	21	SANDY CLAY TO CLAYEY SAND (CL-SC) Medium dense, moist, brown and tan, some silt, carbonate nodules	26	99	790
40						

Project: MATADERO CREEK BRIDGES Waverley Street, Palo Alto, California	Log of Boring No.11

Depth Ft	Samples	Blows/Ft	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compress. Strength, psf
			SANDY CLAY TO CLAYEY SAND (CL-SC) ...(CON'T)			
	9	44		28	97	830
45			SANDY CLAY (CL) Stiff, moist, brown and gray, some gravel, coarse grained sand			
	10	24	SILTY CLAY (CL) Stiff, moist, blue-gray, layers of Sandy Clay Sandy Silt, occasional rootlets	33	88	1760
50						
	11	34	Gray			
55						
	12	32	SAND (SW) Dense, moist, gray and brown, well graded, some gravel			
60			SILTY CLAY (CL) Very stiff, moist, brown			
	13	41		24	102	4080
65						
	14	39		37	84	3850
70			Gray and brown			
	15	68	Calcareous depoit	20	108	4910
75						
	16	22	SILTY CLAY (CL) Stiff, moist, brown, trace of fine sand, occasional gravel	28	96	1300
80			SILTY SAND (SM) Dense, moist, medium grained, brown			
	17	44	SILTY SAND (CL) Very stiff, moist, gray and brown BOTTOM OF BORING AT 85 FEET	31	91	3300

Project:8815021-R	Woodward-Clyde Consultants	Figure 3b

Project: MATADERO CREEK BRIDGES
Waverley Street , Palo Alto, California

Log of Boring No. 12

Date Drilled: August 17, 1988
Type of Boring: Rotary Wash
Hammer: 140 LBS

Remarks: Waverley street NW bank, west side of street

Location:

Depth Ft.	Samples	Blows/Ft	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compress. Strength, psf
			Surface Elevation: ± 22			
			7"ASPHALTIC CONCRET 5"AGGREGATE BASE			
	1 ▨	34	SANDY CLAY FILL (CL) (FILL) Moderately compacted, brown, damp	14	96	1160
5			SANDY CLAY (CL-CH) Very stiff, damp, dark brown			
	2 ▨	46	▽ Brown, moist, some gravel	22	104	3390
			SANDY CLAY (CL) Very stiff, moist, brown, some gravel			
10						
	3 ▥	50/4" NO RECOVERY	SANDY GRAVEL (GP) Medium dense, damp, brown			
15			SANDY CLAY (CL) Stiff, damp, brown and tan			
	4 ▨	17		14	108	1620
20						
	5 ▥	83	SANDY GRAVEL (GW) Dense, damp, brown and gray, gravel to 1" diameter, trace clay binder			
25						
	6 ▥	54				
30			SILTY CLAY (CL) Stiff, moist, brown, some fine sand			
	7 ▨	14				
35						
	8 ▨	16	} Silty Clay, some carbonate deposits	34	88	1210
40			} Sand and gravel			

Project:8815021-R

Woodward-Clyde Consultants

Figure 4a

Project: MATADERO CREEK BRIDGES
Waverley Street, Palo Alto, California

Log of Boring No. 12

Depth Ft.	Samples	Blows/Ft	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compress. Strength, psf
	9	10	SILTY CLAY (CL)...(CON'T)			
			BOTTOM OF BORING AT 41-1/2 FEET			
45						
50						
55						
60						
65						
70						
75						
80						

Project:8815021-R

Woodward-Clyde Consultants

Figure 4b

Project: BRYANT STREET BICYCLE BRIDGE
Palo Alto, California

Log of Boring No. 1

Date Drilled: November 11, 1983
Type of Boring: 6-inch Auger
Hammer Weight: 140 pounds
Remarks:

Depth, Ft.	Samples	Blows/Ft.	MATERIAL DESCRIPTION	LABORATORY TESTS Moisture Content, %	 Dry Density, pcf	 Unconfined Compressive Strength, psf
			Surface Elevation:			
			S A N D Y C L A Y F I L L (CL) Moderately compacted, damp, dark brown			
	1 ▨	12		21	93	
5			S I L T Y C L A Y (CH) Stiff, moist, dark gray			
			S I L T Y S A N D (SM) Loose, damp, dark gray-brown			
	2 ▨	15				
10			S I L T Y C L A Y (CL) Very stiff, damp, brown			
			G R A V E L L Y S A N D Medium dense, gray ▽ 1 hr ▽ ATD			
	3 ▨	22	Clayey			
15						
			S I L T Y C L A Y (CL) Stiff, light brown			
	4 ▨	14		26	96	
20	5 ▨	9/6"				
			Bottom of Boring at 20 feet			
25						
30						

LEGEND:

▨ 22 ← 2-INCH MODIFIED CALIFORNIA SAMPLER
BLOW COUNT WITH A 140-LB. HAMMER FALLING 30 INCHES

▽ ← WATER LEVEL MEASURED:
ATD ← At Time of Drilling
1 hr. ← In Hours After Drilling

Proj. No. 16119-V

Woodward-Clyde Consultants

Figure 2.

Project: BRYANT STREET BICYCLE BRIDGE
Palo Alto, California

Log of Boring No. 2

Date Drilled: November 11, 1983
Type of Boring: 6-inch Auger
Hammer Weight: 140 pounds

Remarks: For symbol explanations, see Legend on Figure 2.

Surface Elevation:

Depth, Ft.	Samples	Blows/Ft.	MATERIAL DESCRIPTION	LABORATORY TESTS: Moisture Content, %	LABORATORY TESTS: Dry Density, pcf	LABORATORY TESTS: Unconfined Compressive Strength, psf
	1	10	CLAYEY GRAVEL FILL (GC) Poorly compacted, moist, dark gray and brown	25	94	
5	2	17	SILTY CLAY (CH) Stiff, moist, black	18	104	
			SILTY CLAY (CL) Very stiff, moist, light brown			
10	3	45	GRAVELLY SAND (SW) Dense, moist, brown ▽ ATD			
15	4	18				
20			SILTY CLAY (CL) Stiff, brown			
			Bottom of Boring at 21 feet			
25						
30						

Proj. No. 16119-V

Woodward-Clyde Consultants

Figure 3.

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
F24297.A1.03	MB-1	SHEET 1 OF 3

SOIL BORING LOG

PROJECT SCVWD Bridges LOCATION Palo Alto-Matadero Creek

ELEVATION 25.4 MSL DRILLING CONTRACTOR HEW Drilling Co

DRILLING METHOD AND EQUIPMENT CME 75, HSA

WATER LEVEL AND DATE 10/8/87, 17' START 1:20 10/8/87 FINISH 4:00 10/8/87 LOGGER S Madsen

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6" (N)	SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
0					FAT CLAY, black, wet (CH) FILL		
5		S-1	1.5	3 4 5 (9)	FAT CLAY, black, wet, stiff (CH) FILL		PPT = 1.7, 1.8 TSF
10		S-2	1.2	5 6 7 (13)	LEAN CLAY, tan, wet, very stiff (CL)		PPT = 3.0, 3.2 TSF
15		S-3	1.5	1 2 3 (5)	LEAN CLAY interbedded with SILT with thin layers of SILTY SAND, greenish tan, wet, firm and loose (CL, ML, SM)		PPT = 0.5, 1.2 TSF in SILTY CLAY ▽ Groundwater level at time of drilling
20		S-4	1.5	1 3 5 (8)	LEAN CLAY, mottled tan, grey, and orange, wet, stiff, thin threads of white fine sand (CL)		PPT = 2.2, 2.3 TSF
25		S-5	1.5	3 6 4 (10)	SILT, light brown, wet, stiff (ML) SILT WITH SAND, light brown, wet, stiff, contains thin layers of silty sand (ML)		Driller notes sand

CH2M HILL

PROJECT NUMBER	BORING NO.	
F24297.A1.03	MB-1	SHEET 2 OF 3

SOIL BORING LOG

PROJECT SCVWD Bridges LOCATION Palo Alto - Matadero Creek

ELEVATION 25.4 MSL DRILLING CONTRACTOR HEW Drilling Co

DRILLING METHOD AND EQUIPMENT CME 75, HSA

WATER LEVEL AND DATE 17', 10/9/87 START 1530 10/9/87 FINISH [illegible] 10/9/87 LOGGER S. Madsen

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
30		S-6	1.5	2 2 10 (12)	WELL-GRADED SAND, brown, wet, medium, grades fine to coarse with some gravel (SW)		
35							
40		S-7	1.0	0 10 19 (29)	SAND WITH SILT, brown, dense, grades from fine to coarse with trace gravel (SW)		
45							
50		S-8	0.8	9 19 21 (30)	SAND WITH SILT: SAME AS ABOVE		
55							Driller notes clay at 55'

REV 7/86 FORM D1586

PROJECT NUMBER	BORING NUMBER	
F24297.A1.03	MB-1	SHEET 3 OF 3

SOIL BORING LOG

PROJECT SCVWD Bridges LOCATION Palo Alto- Matadero Creek

ELEVATION 25.4 MSL DRILLING CONTRACTOR HEW Drilling Co.

DRILLING METHOD AND EQUIPMENT CME 75, HSA

WATER LEVEL AND DATE 17' 10/8/87 START 1100 10/6/87 FINISH 400 10/8/87 LOGGER S Madsen

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
60		S-9	1.5	4 5 5 (10)	LEAN CLAY, greenish grey, wet, stiff (CL)		PPT=2.2, 2.4 TSF
65							
70		S-10	1.5	3 8 9 (17)	LEAN CLAY, grey, wet, very stiff		PPT=2.5, 2.8 TSF
75							
80		S-11	1.5	7 10 10 (20)	LEAN CLAY, brownish grey, wet, very stiff (CL)		PPT= 2.7 TSF
		EOB= 81.5'					
85							

CH2M HILL

PROJECT NUMBER	BORING NUMBER
F24297.A1.03	MB-2 SHEET 1 OF 4

SOIL BORING LOG

PROJECT SCVWD Bridges LOCATION Palo Alto - Matadero

ELEVATION 26.4 DRILLING CONTRACTOR HEW Drilling Co.

DRILLING METHOD AND EQUIPMENT CME 75, HSA

WATER LEVEL AND DATE 15' 10/9/87 START 1:30 10/9/87 FINISH 1000 10/12/87 LOGGER S Madsen

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6" (N)	SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
0							
		S-1	1.0	3 5 5 (10)	FAT CLAY, dark brown, moist, very stiff, contains some sand (CH)		PPT > 4.5 TSF TV > 2.5 TSF
5		ST-2	2.5	PUSH	FAT CLAY: Same as above but stiff		PUSHING 500psi PPT = 2.4 TSF TV = 0.5 TSF
10		S-3	1.5	3 7 10 (17)	SANDY LEAN CLAY, tan, dry, very stiff (CL-ML)		PPT = 2.8, 3.5 TSF
		ST-4	2.5	PUSH	CLAYEY SAND, tan, moist, medium, (SC)		PUSHING 450 psi
15							▽ water level at time of drilling
		S-5	0.8	3 5 5 (10)	SILTY SAND, tan, moist, medium, trace gravel (SM)		
20		S-6	1.5	3 4 5 (9)	LEAN CLAY grey and tan, moist stiff (CL)		PPT = 1.4 TSF
		ST-7	2.2	PUSH	LEAN CLAY, mottled tan and grey, moist, firm to stiff, traces of sand and gravel (CL-ML)		PUSHING 400 psi PPT = 1.28 TSF TV = 0.45 TSF
25		S-8	1.5	2 2 4 (6)	LEAN CLAY, mottled tan and grey, moist, soft to firm (CL-ML)		PPT = 0.75 TSF
		ST-9	2.5	PUSH	LEAN CLAY, mottled tan and grey, moist, firm (ML)		PUSHING 325 psi PPT = 0.8, 0.6 TSF

CH2M HILL

PROJECT NUMBER F34297.A1.03

BORING NUMBER MB-2 SHEET 2 OF 4

SOIL BORING LOG

PROJECT SCVWD Bridges LOCATION Palo Alto - Matadero

ELEVATION 26.4 MSL DRILLING CONTRACTOR HEW Drilling Co

DRILLING METHOD AND EQUIPMENT CME 75; HSA

WATER LEVEL AND DATE 15' 10/9/97 START 8:30 10/9/97 FINISH 10:00 10/12/97 LOGGER S Madsen

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6" (N)	SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
30							
35		S-10	1.5	3 5 6 (11)	LEAN CLAY, mottled tan and grey, moist, stiff to very stiff, contains traces of coarse sand (CL)		PPT = 2.5, 2.1 TSF
		ST-11	2.0	PUSH	SANDY LEAN CLAY, grey, moist, stiff (CL)		PUSHING 300psi PPT = 1.5, 1.25 TSF
40							
45		S-12	1.5	2 3 4 (7)	SANDY CLAY, blueish grey, moist, firm, sand grades fine (ML)		PPT = 0.5 TSF
50		S-13	1.5	2 3 6 (9)	Interbedded SILTY CLAY, SILT, and SILTY FINE SAND; blueish grey, moist, stiff (CL, ML, SM)		PPT = 1.75 in SILTY CLAY
55		S-14	1.5	2 3 5 (8)	SILTY CLAY, blueish grey, moist, stiff (CL-ML)		PPT = 1.2, 1.1 TSF (Tip of sampler contained brown sand)

PROJECT NUMBER	BORING NUMBER
F24297.A1.03	MB-2 SHEET 3 OF 4

SOIL BORING LOG

PROJECT SCVWD Bridges LOCATION Palo Alto, Matadero

ELEVATION 264 MSL DRILLING CONTRACTOR HEW Drilling Co.

DRILLING METHOD AND EQUIPMENT CME 75 HSA

WATER LEVEL AND DATE 15' 10/9/97 START 8:30 10/9/97 FINISH 1000 10/12/97 LOGGER S Madsen

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6" (N)	SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
60		S-5	1.5	3 4 5 (9)	LEAN CLAY, blueish grey, moist, stiff (CL)		PPT = 2.5, 1.6 TSF
65		ST-16	2.6	PUSH	SANDY LEAN CLAY, grey, moist, stiff (CL)		PUSHING 400 PPT = 1.8, 1.3 TSF
70							
75		S-17	1.5	4 4 5 (9)	LEAN CLAY, greenish grey, moist, stiff (CL)		PPT = 0.9, 0.9 TSF
80							
85		S-18	1.5	2 4 6 (10)	LEAN CLAY, brown mottled with grey, moist, stiff		PPT = 1.5, 1.25 TSF

PROJECT NUMBER	BORING NUMBER
F24297.A1.03	MB-2 SHEET 4 OF 4

SOIL BORING LOG

PROJECT SCVWD Bridges LOCATION Palo Alto: Matadero

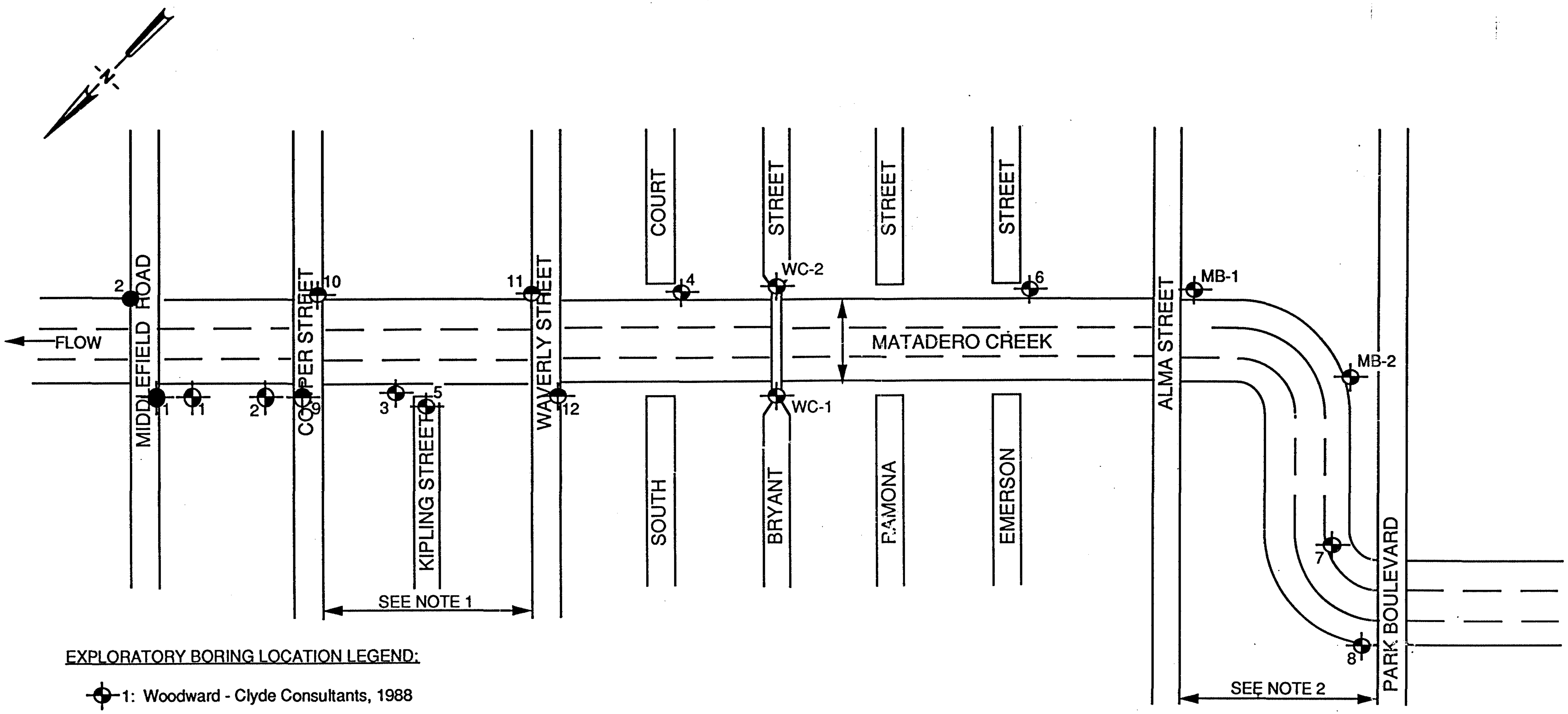
ELEVATION 26.4 MSL DRILLING CONTRACTOR HEW Drilling Co.

DRILLING METHOD AND EQUIPMENT CME 75, HSA

WATER LEVEL AND DATE 15' 10/9/87 START 8:30 10/9/87 FINISH 10:00 10/12/87 LOGGER S Madsen

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6" (N)	SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
90							
95		S-19	1.5	2 4 6 (10)	LEAN CLAY, brown mottled with bluish grey, moist, stiff (CL)		PPT = 1.7, 1.1 TSF
		EOB = 96.5'					
100							

FIGURES



EXPLORATORY BORING LOCATION LEGEND:

- ⊕-1: Woodward - Clyde Consultants, 1988
- ●-1: Woodward - Clyde Consultants, 1987
- ⊕-9: Woodward - Clyde Consultants, 1988 (for bridges)
- ⊕-WC-1: Woodward - Clyde Consultants, 1983
- ⊕-MB-1: CH2M Hill, 1987

NOTES:

1. Between approximately Cowper and Waverly Streets, the channel will be widened and deepened.
2. Between approximately Alama Street and Park Boulevard, a U-Frame channel section will be provided.
3. Not to Scale.

SITE AND BORING LOCATION PLAN
MATADERO CREEK IMPROVEMENTS
Palo Alto, California

Project No. 8810070-R
Woodward-Clyde Consultants

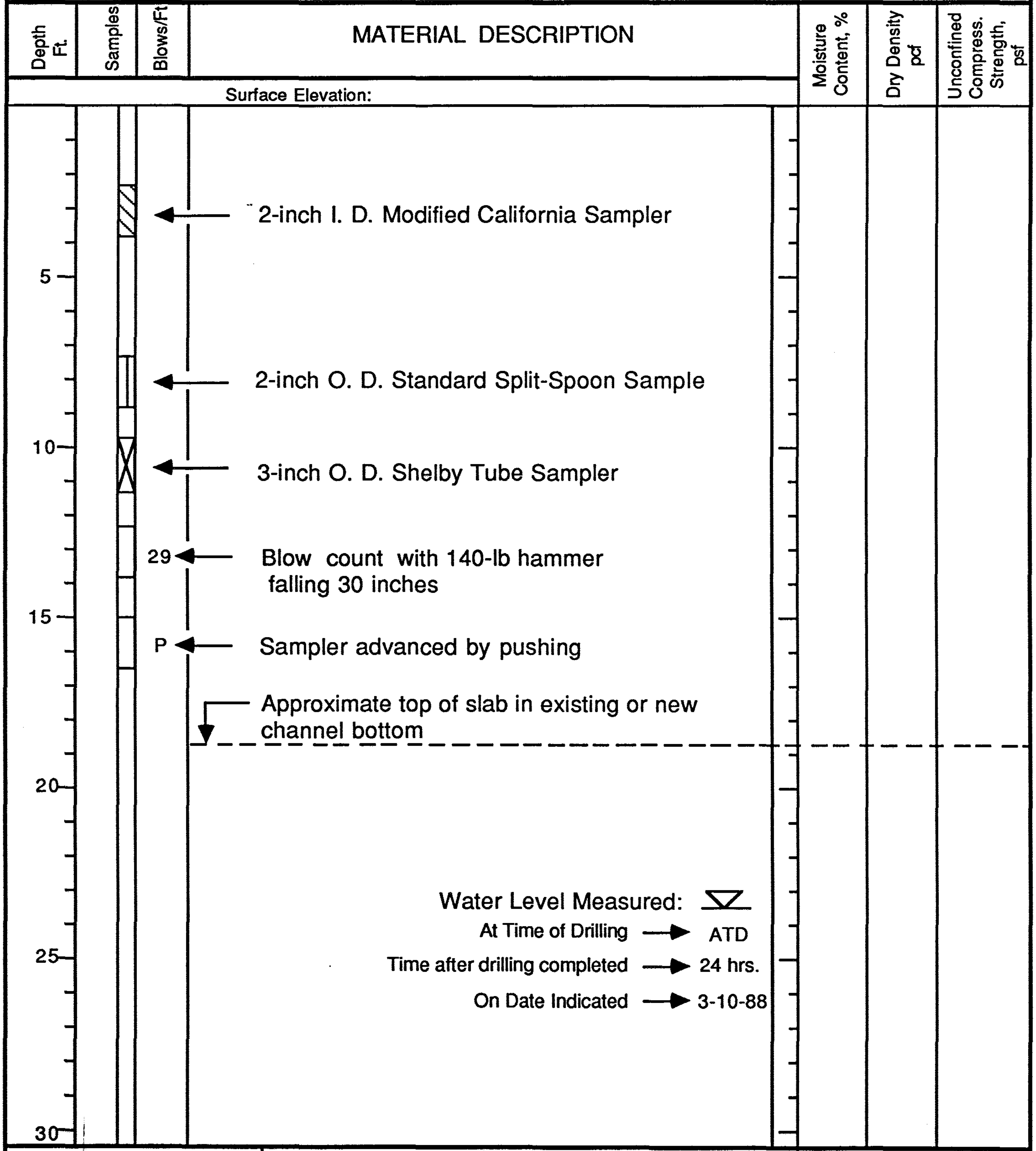
Figure 1

Project: MATADERO CREEK FLOODWALLS
Palo Alto, California

Boring Log Legend Sheet

Date Drilled:
Type of Boring:
Hammer:

Remarks:



2-inch I. D. Modified California Sampler

2-inch O. D. Standard Split-Spoon Sample

3-inch O. D. Shelby Tube Sampler

Blow count with 140-lb hammer falling 30 inches

Sampler advanced by pushing

Approximate top of slab in existing or new channel bottom

Water Level Measured: ▽

At Time of Drilling → ATD

Time after drilling completed → 24 hrs.

On Date Indicated → 3-10-88

Project: MATADERO CREEK FLOODWALLS
Palo Alto, California

Log of Boring No.1

Date Drilled: AUGUST 4, 1988
Type of Boring: 6-Inch Flight Auger
Hammer: 140 lbs.

Remarks: NW bank -4' behind channel lining, Middlefield Rd.
Location:

Surface Elevation: + 2 ft. Above concrete channel lining; 14.5±

Depth Ft.	Samples	Blows/Ft	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compress. Strength, psf
			SANDY CLAY FILL (CL) Moderately compacted, damp, brown, some gravel (FILL)			
5	-	P	SILTY CLAY (CL-CH) Very stiff to hard, moist, dark brown, occasional gravel			
	1	P	SANDY CLAY, (CL) Very stiff, moist, brown			
10	2	25	SANDY GRAVEL (GP) Medium dense, brown, some clay binder ▽ After Drilling ▽ ATD	15	109	-
15	3	P				
			SILTY SAND (SM) Medium dense, fine to medium grained, brown			
20	4	18	SANDY CLAY (CL) Stiff, light tan, carbon staining, carbonate deposits	22	102	1390
25	5	74	SANDY GRAVEL (GW) Medium dense, brown, well graded, with gravel up to 2 inch diameter With clay lenses	9	126	-
30						
35	6	17	SILTY CLAY (CL) Stiff, very silty, trace of fine sand, blue-gray and brown	28	93	1900
			BOTTOM OF BORING AT 36-1/2 FEET			
40						

Project: MATADERO CREEK FLOODWALLS
Palo Alto, California

Log of Boring No. 2

Date Drilled: AUGUST 4, 1988
Type of Boring: 6-Inch Flight Auger
Hammer: 140 lbs.

Remarks: NW Bank -5' behind channel lining, between Middlefield Rd. and Cowper St.
Location:

Surface Elevation: + 2 ft. Above concrete channel lining; 15.6 ±

Depth Ft.	Samples	Blows/Ft	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compress. Strength, psf
			SANDY CLAY FILL (CL) (FILL) Moderately compacted, damp, brown, some gravel			
	1	P				
	1A	27	SILTY CLAY (CL-CH) Very stiff to hard, moist, dark brown, occasional sand	25	95	7110
5						
	1B	29	SANDY CLAY/CLAYEY SAND (CL-SC) Very stiff, moist, brown, some gravel	19	101	6290
	2	P				
	2A	33	CLAYEY SAND (SC) Medium dense, very moist, brown, grading coarse with depth After Drilling			
10				11	113	
	3	21	SANDY GRAVEL (GW) Loose to medium dense, brown sandy clay lenses, well graded, gravel to 2" diameter ATD	16	112	
15						
	4	16	SANDY CLAY (CL) Stiff, grey and brown, some silt	26	97	6960
20						
	5	P				
25			SANDY GRAVEL (GW) Medium dense, brown, sandy clay layers up to about 6" thick			
	6	57				
				13	120	
30						
35						
			SILTY CLAY (CL) Stiff, grey and brown, some sand, carbonate deposits			
	7	13		38	84	1390
40						
			BOTTOM OF BORING AT 40 FEET			

Project:8810070-R | **Woodward-Clyde Consultants** | Figure 4

Project: MATADERO CREEK FLOODWALLS **Palo Alto, California**	Log of Boring No. 3

Date Drilled: AUGUST 5, 1988
Type of Boring: 6-Inch Flight Auger
Hammer: 140 lbs.

Remarks: NW Bank -6' behind channel lining, between Cowper St. and Waverley St.
Location:

Depth Ft.	Samples		Blows/Ft	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compress. Strength, psf
				Surface Elevation: + 2-1/2 ft. Above concrete channel lining; 19.0±			
				SANDY CLAY FILL (CL) Moderately compacted, damp, brown, some gravel (FILL)			
	1	▨	28	SILTY CLAY (CL-CH) Dark brown, moist, hard, some roots, some fine sand	18	100	11,220
5				SANDY CLAY (CL) Very stiff, moist, light brown, some gravel			
				BOTTOM OF BORING AT 6-1/2 FEET DUE TO POSSIBLE OBSTRUCTION			
10							
15							
20							
25							
30							
35							
40							

Project:8810070-R	**Woodward-Clyde Consultants**	Figure 5

Project: MATADERO CREEK FLOODWALLS
Palo Alto, California

Log of Boring No. 4

Date Drilled: AUGUST 3, 1988
Type of Boring: 6-Inch Flight Auger
Hammer: 140 lbs.

Remarks: SE Bank -4' behind channel lining, immed. SW of south court
Location:

Surface Elevation: +1 ft. Above concrete channel lining; 20.8±

Depth Ft.	Samples	Blows/Ft	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compress. Strength, psf
			SANDY CLAY FILL (CL) Moderately compacted, damp, brown, some gravel (FILL)	22	88	4970
	1	25	SILTY CLAY (CL-CH) Very stiff to hard, damp, dark brown, occasional roots, trace gravel			
5	2	33	Brown, some gravel	15	110	7770
			SANDY GRAVEL (GW) Dense, wet, brown, some clay binder			
10	3	45	moist After Drilling ATD	13	104	
15	4	13	GRAVEL (GW) Loose, brown, well graded gravel to 1-1/2" diameter OVA (organic vapor analyser) up to 1.5ppm dissipates very rapidly	15	117	
20	5	13	SILTY CLAY (CL) Stiff, brown, some fine sand	22	102	
25	6	44	SANDY GRAVEL (GW) Medium dense, brown	14	115	
			BOTTOM OF BORING AT 26-1/2 FEET			
30						
35						
40						

Project: 8810070-R

Woodward-Clyde Consultants

Figure 6

Project: MATADERO CREEK FLOODWALLS
Palo Alto, California

Log of Boring No. 5

Date Drilled: AUGUST 18, 1988
Type of Boring: Rotary Wash
Hammer: 140 lbs.

Remarks: Kiping Street, NW bank 25' from top of concrete lining
Location:

Depth Ft.	Samples	Blows/Ft	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compress. Strength, psf
			Surface Elevation: + 2-1/2 ft. Above concrete channel lining; 19.0±			
			6" ASPHALTIC CONTRETE AND 12" AGGREGATE BASE (FILL)			
	1 ▨	51	SILTY CLAY (CL) Very stiff to hard, damp, occasional gravel to 1/2" diameter, roots, dark brown			
5						
	2 ☐	64	SANDY GRAVEL (GP) Medium dense, damp, brown, gap-graded, some clay binder, gravel to 1" diameter			
10						
			Silty Clay or Sandy Clay layers			
	3 ▨	40		19	106	
15						
	4 ▨	19	SILTY CLAY (CL) Stiff to very stiff, brown,some sand, carbon staining, carbonate deposits	26	97	2690
20						
	5 ▨	12	Occasional fine gravel	28	91	1090
25						
			SANDY SILT/SILTY SAND (ML-SM) Medium dense, blue-gray and brown, fine grained			
	6 ▨	18	SILTY CLAY (CL) Medium stiff, blue-gray and brown	29	94	970
30			BOTTOM OF BORING AT 29-1/2 FEET			
35						
40						

Project: MATADERO CREEK FLOODWALLS
Palo Alto,California

Log of Boring No. 6

Date Drilled: AUGUST 3, 1988
Type of Boring: 6-Inch Flight Auger
Hammer: 140 lbs.

Remarks: SE Bank -5' behind channel lining, immed. SW of Emerson Street
Location:

Surface Elevation: + 2-1/2 ft. Above concrete channel lining; 24.5±

Depth Ft.	Samples	Blows/Ft	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compress. Strength, psf
			SANDY CLAY FILL (CL) Moderately compacted, damp, brown (FILL)			
	1	34	SANDY CLAY (CL-CH) Very stiff to hard, damp, trace gravel, dark brown	22	91	5790
5			SILTY CLAY (CL) Stiff, moist, dark brown			
	2	34		20	100	4060
			SILTY CLAY (CL) Very stiff, moist, tan, very silty, occanical gravel and fine sand			
10			CLAYEY SILT (ML) Medium dense, moist, light tan, some gravel and fine sand After Drilling	16	112	
	3	51		13	114	
15			GRAVELLY SAND (SW) Dense, tan some clay binder, well graded ATD			
	4	19	SANDY CLAY (CL) Stiff, tan, fine-grained sand lenses of Clayey Sand	24	103	2500
20						
	5	P	Very sandy			
25						
30	6	32	Silty clay with fine sand	25	100	3920
			SILTY CLAY (CL) Stiff, blue-gray, grading coarser with depth			
35						
			SILTY CLAY (CL) Stiff, blue-gray and brown, occasional gravel			
	7	28		24	100	1580
40			BOTTOM OF BORING AT 40 FEET			

Project:8810070-R

Woodward-Clyde Consultants

Figure 8

Project: MATADERO CREEK FLOODWALLS
Palo Alto, California

Log of Boring No. 7

Date Drilled: AUGUST 18, 1988
Type of Boring: Rotary Wash
Hammer: 140 lbs.

Remarks:Park City LeasingProperty, east end of site
Approx. 8 Ft. from channel lining
Location:

Surface Elevation: 28.0 ±

Depth Ft.	Samples	Blows/Ft	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compress. Strength, psf
			3" ASPHALTIC CONCRETE 9"AGGREGATE BASE			
	1 ▨	37	SILTY CLAY FILL (CL) Moderately compacted, brown, some fine sand damp	14	100	2430
5	2 ▨	19	SILTY CLAY (CL-CH) Stiff, moist, dark brown, rootlets, trace fine sand	32	86	1540
10	3 ▨	35	SANDY CLAY, (CL) Very stiff, moist, brown, occasional gravel	24	100	3730
15	4 ▨	31	CLAYEY SAND (SC) Medium dense, brown, some gravel	25	99	710
			SANDY CLAY (CL) Stiff to very stiff, brown, some gravel			
20	5 ▨	21	SILTY CLAY (CL) Stiff, brown, occasional fine gravel, carbonate deposits	24	98	2990
25	6 ▯	87	SANDY GRAVEL (GW) Dense, brown, some clay binder, gravel to 1" diameter			
30	7 ▨	23	SILTY CLAY (CL) Stiff to very stiff, brown, some sand, carbon staining	24	101	3290
			BOTTOM OF BORING AT 31-1/2 FEET			
35						
40						

Project: 8810070-R

Woodward-Clyde Consultants

Figure 9

Project: MATADERO CREEK FLOODWALLS
Polo Alto, California

Log of Boring No. 8

Date Drilled: AUGUST 18, 1988
Type of Boring: Rotary Wash
Hammer: 140 lbs.

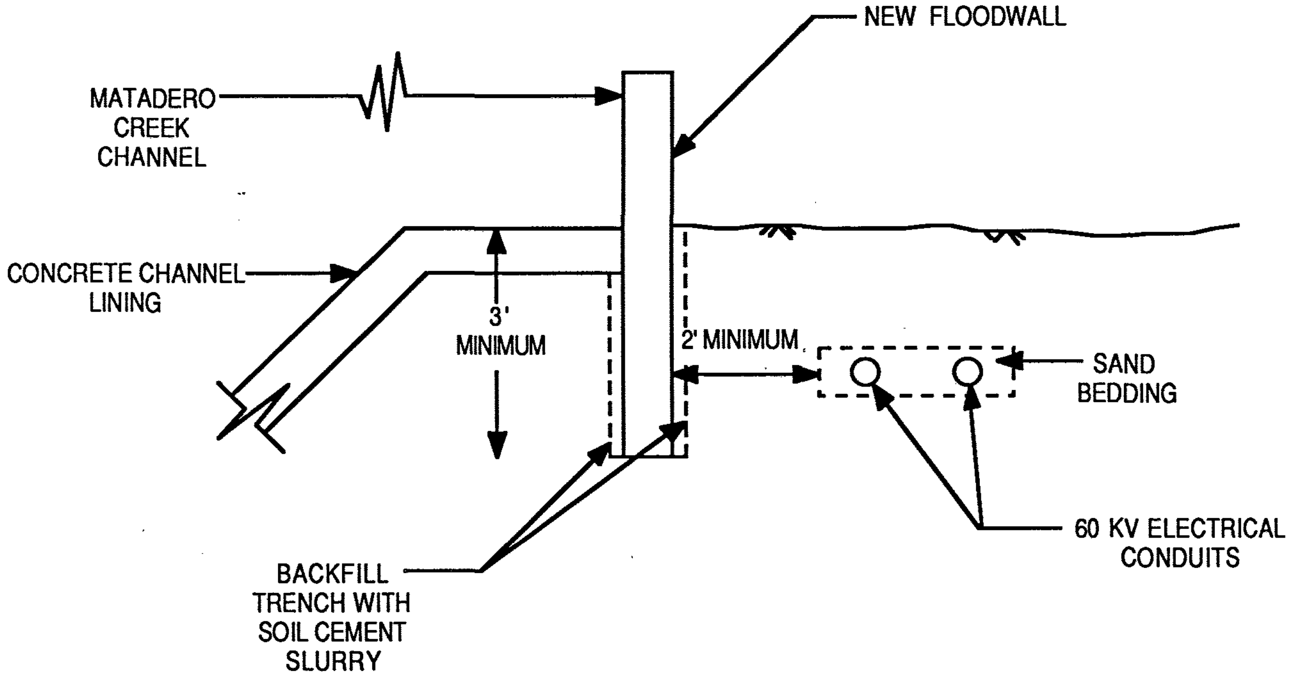
Remarks:Park City Leasing Property North Park Blvd.,
10 Ft. from top of concrete lining
Location:

Depth Ft.	Samples	Blows/Ft	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compress. Strength, psf
			Surface Elevation: 25.6±			
			3" ASPHALTIC CONCRETE 6" AGGREGATE BASE			
	1 ▨	17		25	95	1990
5			SANDY CLAY (CH) Stiff to very stiff, dark brown, some gravel			
	2 ▨	20		29	93	1510
10						
	3 ▨	12	SANDY CLAY, (CL) Stiff, brown, carbonate deposits occasional gravel	26	95	
15						
	4 ▨	18	SILTY CLAY (CL) Stiff, brown and tan, some sand	26	99	1950
20						
	5 ▨	15	Trace of fine sand at 23 feet, carbon staining	30	93	2620
25						
	6 ▨	20	SANDY CLAY (CL) Stiff, brown and gray	28	95	1800
30			SANDY CLAY (CL) Stiff, brown and tan carbonate deposits carbon staining			
	7 ▨	11		31	92	1230
			BOTTOM OF BORING AT 33-1/2 FEET			
35						
40						

Project: 8810070-R

Woodward-Clyde Consultants

Figure 10

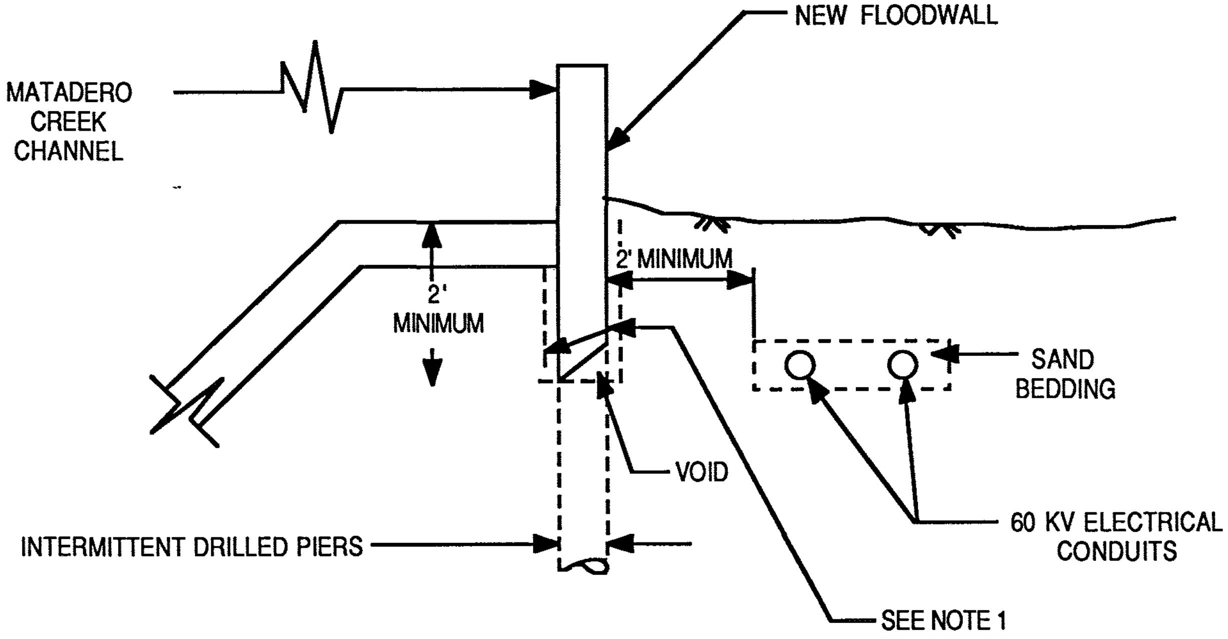


TYPICAL SECTION AT NORTHWEST BANK

NOTES:

1. DO NOT PLACE FLOODWALL OVER EXISTING SEWER
2. EXCAVATE TRENCH, SET PRECAST FLOODWALL PANEL, AND PLACE SLURRY ON SAME DAY
3. NOT TO SCALE

Project No. 8810070-R **Woodward-Clyde Consultants**	CONTINUOUS STRIP FOOTING OPTION MATADERO CREEK FLOODWALLS Palo Alto, California	Figure 11



TYPICAL SECTION AT NORTHWEST BANK

NOTES:

1. BACKFILL SIDES OF TRENCH WITH SOIL CEMENT SLURRY. LEAVE VOID UNDER PANEL.
2. PROVIDE 45 DEGREE ANGLE AT BASE OF PRECAST PANEL
3. EXCAVATE TRENCH, SET PRECAST FLOODWALL PANEL, AND PLACE SLURRY ON SAME DAY
4. DO NOT PLACE FLOODWALL OVER EXISTING SEWER
5. SPACING OF DRILLED PIERS TO BE DETERMINED
6. NOT TO SCALE

Project No. 8810070-R **Woodward-Clyde Consultants**	DRILLED PIER FOUNDATION OPTION MATADERO CREEK FLOODWALLS Palo Alto, California	Figure 12

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